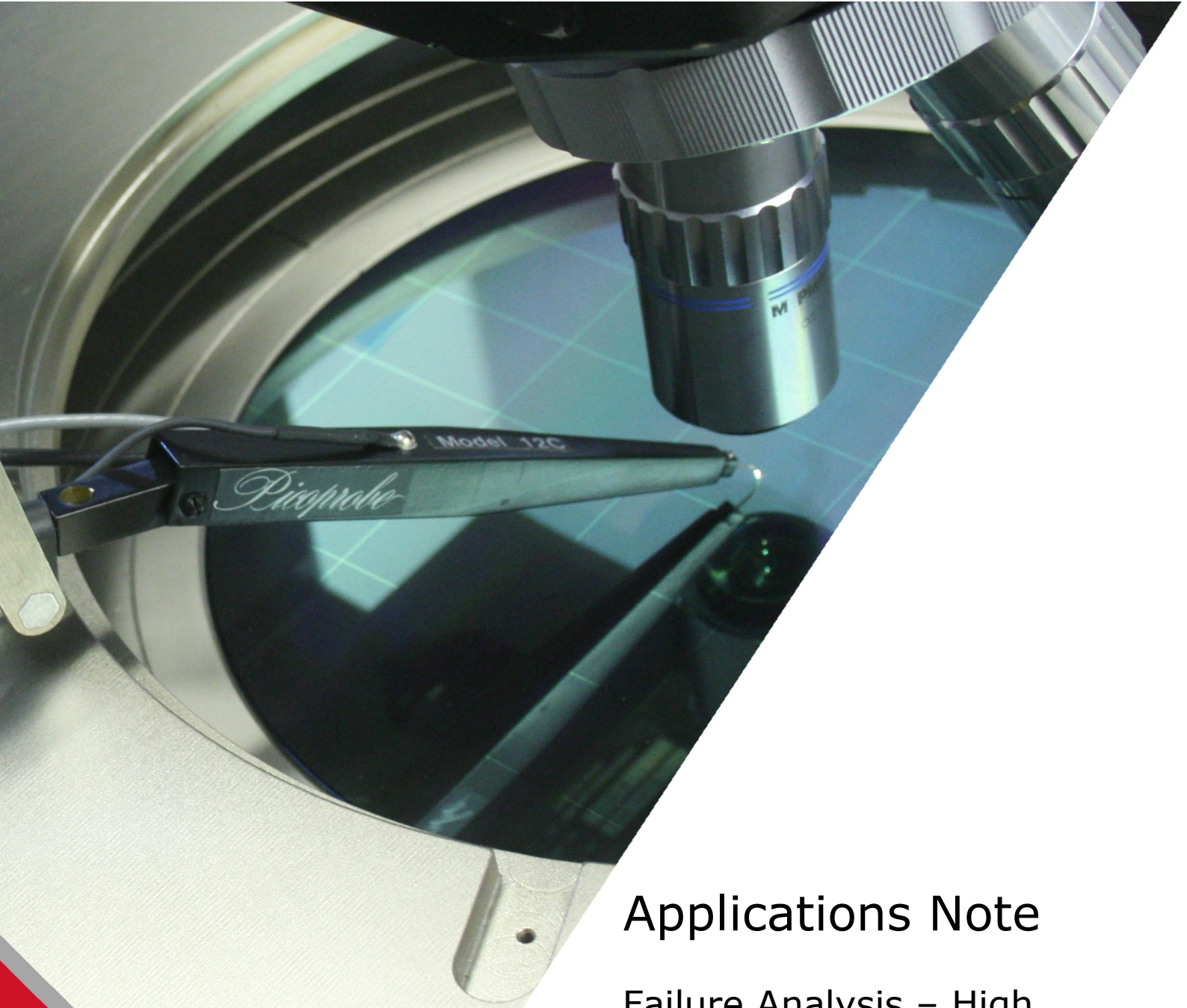


Applications Note

Failure Analysis – High Impedance Probing

Wentworth Laboratories

Failure Analysis – High Impedance Probing

As IC designs become faster, probes become more sophisticated in order to measure today's very high-speed signals. At the same time, probe loading of measured signals has become more of an issue. The question of whether to display the signal at the probe tip, or to estimate the signal without the probe and cable, is an important one that designers must take into account.

The days of general-purpose lab probes are long gone. In today's lab environment, probes must be matched to their intended use. An active probe that displays Vout/Vin will be generally more useful in troubleshooting investigations whereas a Vout/Vsource probe can give a view into the original signal on a 50 Ω line.

Picoprobe®

GGB Industries, the originator of the Picoprobe® line of microwave and oscilloscope probes, has served the on-wafer probing needs of the worldwide semiconductor industry with a line of high impedance troubleshooting probes for diagnostic studies of the internal workings of complex logic and memory chips. This has provided a solution for failure analysis engineers and designers alike as long as they can be easily integrated into the wafer-probing environment.

The GGB range offers both passive and active probes for extending the range of high frequency probing beyond 100 Mhz. Below this level, normal coaxial needle holders are adequate for most applications. However, if the frequency moves above this range, signal integrity or "line noise" becomes an issue. A number of GGB active probe solutions are available right up to 26 GHz.

Amplification of the signal close to the measurement node, allows very low signal levels to be extracted and measured (as shown in figures 1 & 2). Beyond this, RF probes with ground probes need to be used and are available.

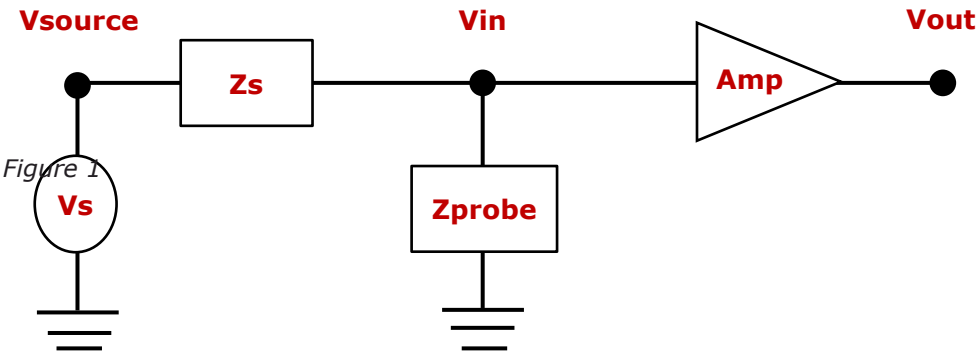


Figure 1

Figure 1 – simplified probe circuit

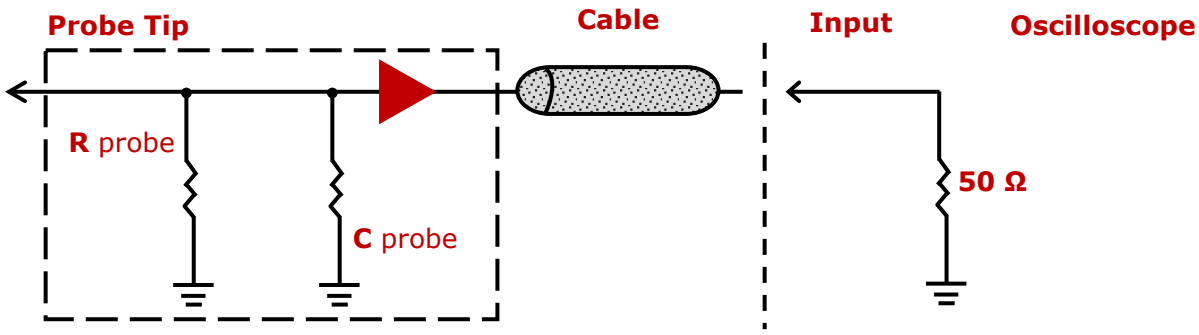


Figure 2 – active probes

Wentworth Active Probing advantage

Wentworth Laboratories has a long-established relationship with GGB Industries, supplying them with individual probes for their line of RF solutions. The two companies have worked together to ensure the smooth integration for the whole range of active and passive probes regardless of the probing environment (sub-zero °C and low noise chambers).

One key requirement for integration requires flexibility in the mounting of the probes to allow in-die access, even if the device is packaged or a probe card is in contact with the devices' bond pads. The Wentworth articulated arm solution provides the engineer maximum positional flexibility to ensure that any device can be probed, regardless of the set-up constraints (see figure 3).

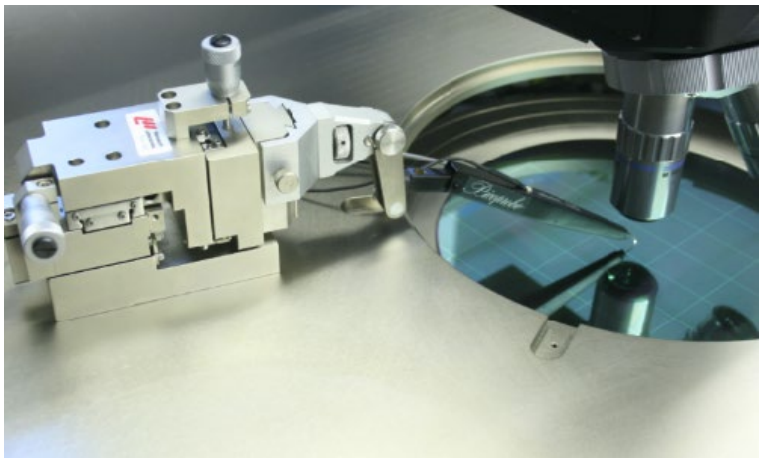


Figure 3

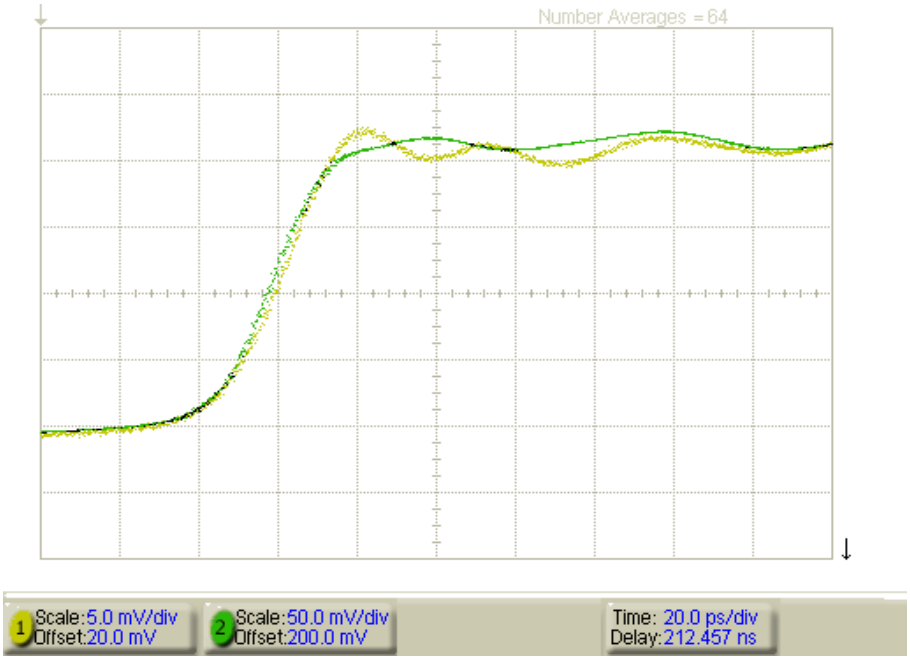


Figure 4

This plot (Figure 4) shows the response of the Picoprobe Model 35 to a 0.25 V, 25 picoseconds rise time input pulse. Both the input pulse (channel 2) and the Model 35 response (channel 1) are displayed simultaneously on a dual channel 20 GHz sampling oscilloscope. The Model 35 probe tip was contacted to a 50 Ω impedance strip line that carried the input signal. Model 35 used only a single contact and did not require a short ground connection.

RF Probes

RF probes can also be used with this configuration by an additional 'planarizable' mounting arm. This allows the multi-probe RF assembly to be tilted to ensure good contact with the die or wafer under test. The large platen arrangement of Wentworth's failure analysis probe stations, provides ample opportunity to locate the RF pre-amp assemblies close to the probe tip.

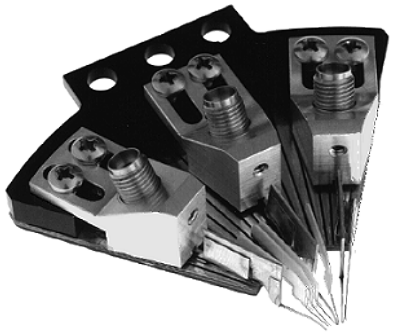
The high-performance microwave probe, which incorporates our patented coaxial design techniques, has inherent low loss and low dispersion characteristics.

All of our Picoprobe® microwave probes have customer-preferred features such as:

- individually spring-loaded Beryllium-Copper tips which provide reliable contacts even when probing non-planar structures;
- direct viewing of probe tips for accurate positioning;
- can be designed to almost any pitch and footprint.

Smaller pitches and Ground-Signal-Ground footprints are recommended for optimum performance.

The multi-contact wedge allows for more chip design flexibility because it is custom configured to your circuit. Four wedges can be used at the same time to probe a complete chip.



With its individually spring-loaded Beryllium-Copper tips, the multi-contact wedge provides reliable contacts, even when probing non-planar structures.

This reliable low resistance contact is one of the keys to providing highly repeatable measurements. The multi-contact wedge also provides direct viewing of the probe tips for accurate positioning.